

# iGEM 2016 – Microbiology – BMB – SDU

<b>Project type:</b> Bacteriocin  <b>Project title:</b> IMPACT (Intein Mediated Purification with an Affinity Chitin-binding Tag)  <b>Sub project:</b> Purify bacteriocin Thuricin S from <i>E. coli</i> :ER2566	<b>Creation date:</b> 2016.09.29  <b>Written by:</b> Brian Kenn Baltzar  <b>Performed by:</b> Brian Kenn Baltzar & Cathrine Høyer Christensen
--	---

## 1. SOPs in use.

SOP number: SOP0007\_v01 LA plates with antibiotic

SOP number: SOP0022\_v01 Competent cell - freeze-stock

SOP number: SOP0023\_v01 Ca<sup>++</sup> transformation.

Plasmid purification kit

SOP number: SOP0001\_v01 ON culture of *E.coli*

SOP number: SOP0004\_v01 Bacterial freeze stock

SOP number: SOP0017\_v01 Fast digest

SOP number: SOP0105\_v01 Ligation

Gel purification kit

SOP number: SOP0021\_v01 Colony PCR with MyTaq

phusion PCR

SOP number: SOP0009\_v01 TSB transformation

iGEM 2016 SOP0028\_v01 - Bradford Protein Concentration determination

iGEM 2016 SOP0025\_v01 - Impact\_Purification

iGEM 2016 SOP0027\_v01 - MIC

## **2. Purpose.**

To Purify bacteriocin Thuricin S from *E. coli*:ER2566

### 3. Overview.

Day	SOPs	Experiments
1		Design primers with restriction sites for NdeI and SapI
2	SOP0010	Phusion PCR to give gene the correct restriction sites
2		Gel Electrophoresis to test if PCR were successful
2	Fermentas GeneJET Gel Extraction Kit	Purify pPCR product
3	SOP0025_v01	Impact purification, step. 8.1.1 → 8.1.4
4	SOP0021_v01	colony PCR to see which ligations were correct
4	SOP0025_v01	Impact purification, step. 8.1.5
5	SOP0025_v01	Impact purification, step. 8.1.6
6	SOP0025_v01	Impact purification, step. 8.1.7 → 8.1.8
7	SOP0025_v01	Impact purification, step. 8.2.1
8	SOP0025_v01	Impact purification, step. 8.2.2 → 8.2.3
9	SOP0025_v01	Impact purification, step. 8.2.4 → 8.3.9
10	SOP0025_v01	Impact purification, step. 8.4.1 → 8.4.2
10	SOP0028_v01	Bradford Protein Concentration Determination
10	SOP0025_v01	Impact purification, step. 8.4.3
11	SOP0027_v01	Determination of effect with MIC test.

### 4. Materials required.

#### Materials in use

Name	Components (Concentrations)	Manufacturer / Cat. #	Room	Safety considerations
Appropriate medium ex. LB	1% Tryptone 1% NaCl 0.5% Yeast extract	Oxoid Sigma-Aldrich Merck	Media lab or V18-40 5-0	
Glycerol	50 %	AppliChem	Anne Mette, RT	

LB		Anne-Mette		
LA	1% Tryptone 1% NaCl 0.5% Yeast extract 1.5% agar	Oxoid Sigma-Aldrich Merck Difco agar from BD	Anne-Mette Or V18-405-0	
Water	Demineralised milli-Q autoclaved water	Milli-Q water purification system (Millipore)	RT	Water
MyTaq <sup>TM</sup> HS Red Mix	<a href="http://www.bioline.com/documents/product_inserts/MyTaq%E2%84%A2%20HS%20Red%20Mix.pdf#zoom=130">http://www.bioline.com/documents/product_inserts/MyTaq%E2%84%A2%20HS%20Red%20Mix.pdf#zoom=130</a>	Bioline	V18-405a-2	
Reverse primer	Made specific to the template	Sigma-Aldrich		
Forward primer	Made specific to the template	Sigma-Aldrich		
Ligasebuffer		Agilent Technologies	Freezer at 1. Floor	
Ligase			Freezer 1. Floor	Ligase
FastDigest enzyme		Agilent Technologies	Freezer at 1. Floor	
Fast digest green / 10 x FastDigest Buffer		Agilent Technologies	Freezer at 1.	
CaCl <sub>2</sub>	0.1M		Chem room	
MgCl <sub>2</sub>	0.1M		Chem room	MgCl <sub>2</sub>
liquid nitrogen	liquid nitrogen	liquid nitrogen	liquid nitrogen	
Fast digest green		Agilent Technologies	Freezer at 1.	
6x DNA Loading Dye		GeneRuler	fridge floor 1	
Fort. LB		the new Anne-Mette	Autoclave room	

Polyethylene glycol (PEG) 3.350		Sigma Aldrich	Micro Chemical room
Dimethylsulfoxide (DMSO)		Sigma Aldrich	Micro Chemical room
Magnesium chloride (MgCl <sub>2</sub> ) 1M	1M	The New Anne-Mette	Autoclave
Microtiter plates			Chem Room
Tris-base			Chem Room
dH <sub>2</sub> O			Chem Room
Tris-HCl 1M			Chem Room
NaCl 5M			Chem Room
EDTA 0,5M			Chem Room
Tween 20			Chem Room
DTT 1M			Chem Room
Bio-Rad Filter Columns			Chem Room
Bio-Rad Econo-Pac 10DG columns			Chem Room
Chitin Beads			Chem Room
Bio-Rad protein Assay solution			Special Buy
BSA 1 mg/ml			Chem Room

## 5. Other

As competent cells, LB and LA media was used by all parts of our project and not just this protocol the dates for use of these SOPs are not added. This comment deal with SOP number: SOP0007\_v01 and SOP0022\_v01

Gel Electrophoresis is set at 75 V for 30-45 minutes, dependent on the gel percentages.

## 6. Experiment history.

Date (YY.MM.DD)	SOPs	Alterations to SOPs and remarks to experiments																					
16.08.25	SOP0010_v01	<p>Phusion PCR (pPCR) using designed primers with NdeI and SapI restriction sites. Total Volume: 50 µl</p> <p>Following program was used:</p> <table> <tr> <th>Cycle</th><th>°C</th><th>Time (min)</th></tr> <tr> <td>Initial denature</td><td>98</td><td>00:30</td></tr> <tr> <td>Denature</td><td>98</td><td>00:05</td></tr> <tr> <td>Anneal</td><td>69</td><td>00:20</td></tr> <tr> <td>Extention</td><td>72</td><td>00:15</td></tr> <tr> <td>Final extention</td><td>70</td><td>10:00</td></tr> <tr> <td>Hold</td><td>4</td><td></td></tr> </table>	Cycle	°C	Time (min)	Initial denature	98	00:30	Denature	98	00:05	Anneal	69	00:20	Extention	72	00:15	Final extention	70	10:00	Hold	4	
Cycle	°C	Time (min)																					
Initial denature	98	00:30																					
Denature	98	00:05																					
Anneal	69	00:20																					
Extention	72	00:15																					
Final extention	70	10:00																					
Hold	4																						
16.08.25	Gel Electrophoresis	To see if pPCR was successful																					
16.08.25	Plasmid purification	Plasmid purification of pTXB1 our vector.																					
16.08.29	Gel purification	The pPCR product is purified using Fermentas GeneJET Gel Extraction Kit																					
16.09.02	SOP0025_v01	<p>Impact_ Purification step. 8.1.1</p> <table> <tr> <td></td><td>Insert (purified pPCR product)</td><td>pTXB1(Vector)</td></tr> <tr> <td>H2O</td><td>15.5µl</td><td>9.5µl</td></tr> </table>		Insert (purified pPCR product)	pTXB1(Vector)	H2O	15.5µl	9.5µl															
	Insert (purified pPCR product)	pTXB1(Vector)																					
H2O	15.5µl	9.5µl																					

	Buffer	2µl	2µl
	DNA	10µl	5µl
	NdeI	1.5µl	1.5µl
	SapI	1µl	1µl
	FastAP	---	1µl
The reaction stood for 7 hours at 37°C			

16.09.03      SOP0025\_v01      Impact\_Purification step. 8.1.3 → 8.1.4  
*Ligation alterations:*

T7 ligase buffer	10µl
T7 ligase	1µl
DNA insert	1, 2, 20, 0µl
Vector	4µl
H2O	14, 13, 15, 0 µl

16.09.08      SOP0025\_v01      Impact\_Purification step. 8.1.5

*Transformation deviations:*  
5µl ligation mixture were used.

16.09.09      SOP0025\_v01      Impact\_Purification step. 8.1.6 → 8.1.7

16.09.12      SOP0025\_v01      Impact\_Purification step. 8.1.8 → 8.1.9

16.09.12      SOP0025\_v01      Impact\_Purification step. 8.2.1  
1 ml. cell culture *E. Coli*:ER2566 and 2µl were used

16.09.21      SOP0025\_v01      Impact\_Purification step. 8.2.2 → 8.2.3

16.09.15      SOP0025\_v01      Impact\_Purification step. 8.2.4 → 8.2.7

16.09.23      SOP0025\_v01      Impact\_Purification step. 8.2.8 → 8.3.9

16.09.24      SOP0025\_v01      Impact\_Purification step. 8.4.1

16.09.25      SOP0028\_v01      Bradford Protein Concentration determination

16.09.25      SOP0025\_v01      Impact\_Purification step. 8.4.3  
*Aliquots #1 - #6 were pooled*

16.09.27      SOP0027\_v01 -  
MIC

16.09.28      SOP0027\_v01 -  
MIC  
MIC step. 7.3 → 7.9  
*The bacteriocin were diluted 2 fold from row A G, starting with a concentration of 16,7 µg/ml and ending at 0 µg/µl in row G*  
The layout of the microtiter plates were as follows:

Column:	
1	Mueller-Hinton broth
2	Mueller-Hinton broth
3	<i>S. aureus</i> :CC398
4	<i>S. aureus</i> :CC398
5	<i>S. aureus</i> :USA300
6	<i>S. aureus</i> :USA300
7	<i>S. aureus</i> :hVISA
8	<i>S. aureus</i> :hVISA
9	<i>P. aeruginosa</i> :PAO1
10	<i>P. aeruginosa</i> :PAO1

## 7. Sample specification.

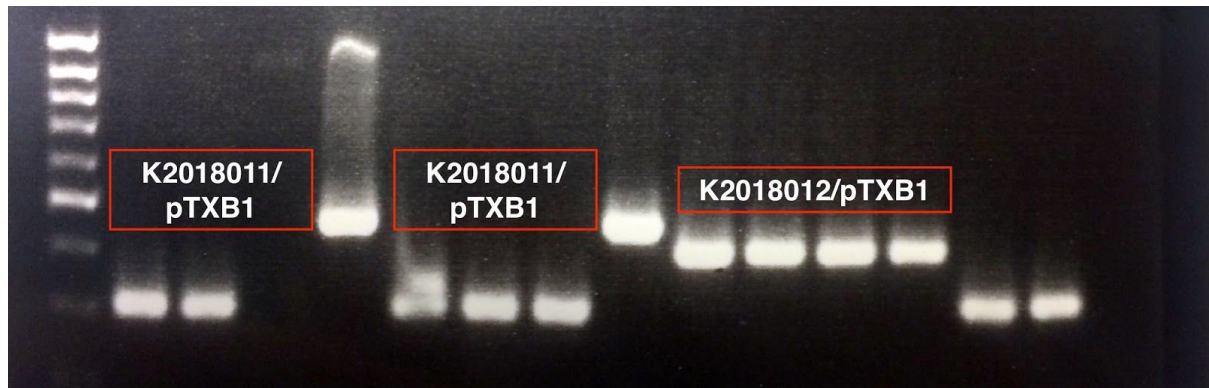
Sample name	Sample content	From	Used for / Saved where
BR33	pSB1C3:k2018011	Freeze-stock	
BR173	pTXB1/K2018011		
BR126	<i>E. Coli</i> :K12/pTXB1	MGJ strains freezer	IMPACT vector
BY150	K2018011 with impact overhangs		
#87	<i>E. Coli</i> :ER2566/pTXB1/K2018011	Freeze-stock	

## 8. Remarks on setup.



## 9. Results and conclusions.

- The following gel image were used to verify that K2018011 were successfully cloned into pTXB1 (the IMPACT vector). Lane 1-3 is K2018011/pTXB1 and they all showed the correct sized band.



- The Bradford assay: We measured  $OD_{595} = 0,05700$ , together with the BSA standard curve (see appendix) we calculated a final protein concentration as being  $33,5 \mu\text{g/ml}$
- The MIC assay gave the following MIC values:

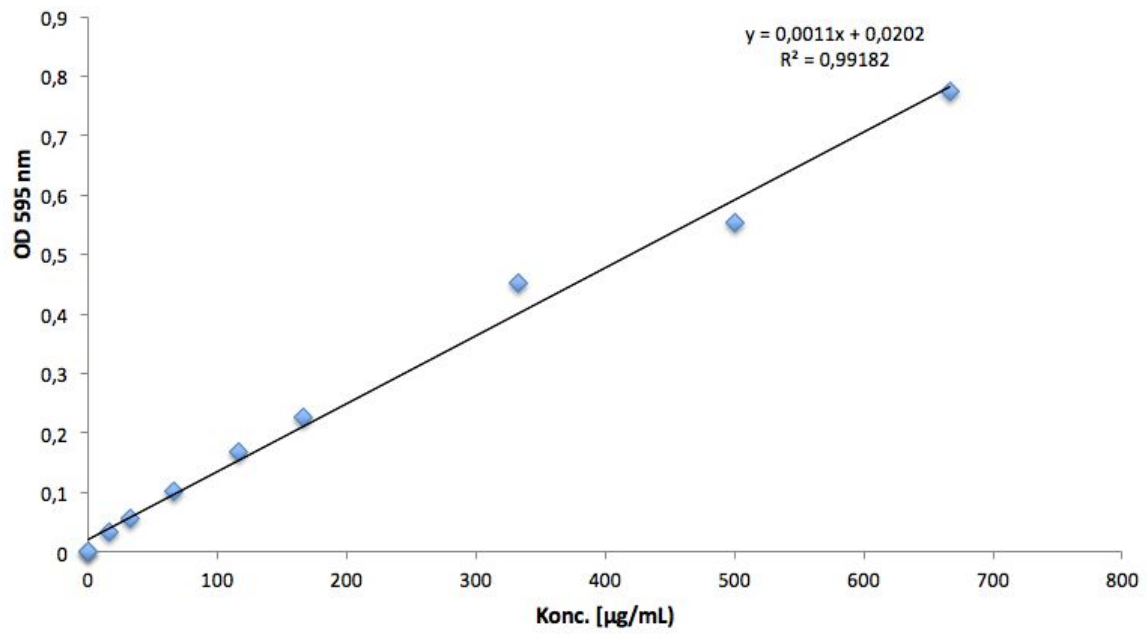
Strain	MIC ( $\mu\text{g/ml}$ )
<i>S. aureus</i> :CC398	16,7
<i>S. aureus</i> :USA300	16,7
<i>S. aureus</i> :hVISA	16,7
<i>P. aeruginosa</i> :PAO1	16,7

Based on the above we concluded that our bacteriocin (Thuricin S) were successfully expressed and purified using the IMPACT system.

Furthermore we showed that our recombinant bacteriocin had antimicrobial effect on three multiresistant *S. aureus* strains one resistant *P. aeruginosa* strain.

We also made a control MIC where we treated the same strains with ampicillin ( $2000 \mu\text{g/ml} \rightarrow 0 \mu\text{g/ml}$ ) and chloramphenicol ( $5000 \mu\text{g/ml} \rightarrow 0 \mu\text{g/ml}$ ), no strains were inhibited which confirms that the strains is resistant.

## 10. Appendixes



*Bradford Assay standard BSA protein curve.*

